2.4.7. Range and Bearing Accuracy

2.4.7.1. Purpose

The purpose of this test is to determine how accurately the radar can determine the bearing and range to a radar target and the effect that this accuracy has upon ingress and attack tactics.

2.4.7.2. General

A precise range and azimuth accuracy test requires external space positioning data; however, an approximate check can be obtained by visually marking on top of a surveyed point and taking the radar derived range and bearing to another surveyed target. The pilot's mark on top technique is critical to this test and the test should be flown at as low an altitude as safety permits. An approximate rule of thumb for mark on top accuracy for an experienced evaluator is half of the altitude above the mark on top point. Range and bearing accuracy is important since it affects the utility of the vectors that the pilot gets from the radar as well as the target position input to the weapons delivery computer and to the seekers of stand-off weapons.

2.4.7.3. Instrumentation

Data Cards and an optional voice recorder are required for this test.

2.4.7.4. Data Required

Record the test airplane altitude, heading and radar derived bearing and range to a surveyed radar target as the test airplane marks on top of another surveyed point. Record qualitative comments concerning the utility of the radar derived bearing and range to the target during mission relatable ingresses and simulated target attacks.

2.4.7.5. Procedure

Before the test flight, select a visual target in the test area that has a surveyed latitude and longitude and a surveyed radar target at 15 to 20 nm away from the visual target. The radar target does not have to be in the test area. Descend to the test altitude. Fly a heading to the target that places the target within the radar search volume and keep the cursors as close to the target as possible. Perform a fly-over of the visual target. At fly-over, mark the bearing and range to the radar target, and then the test airplane altitude and heading. During mission relatable ingresses and simulated weapon deliveries, note the utility that the read out of target bearing and range provides as an aid for flying to the target and delivering weapons.

2.4.7.6. Data Analysis and Presentation

For radars that provide a relative bearing to the target, add a right target bearing to the test airplane heading to get the magnetic bearing to the target. Subtract a left bearing to the target to get the magnetic bearing to the target. Use the difference between the known latitudes and longitudes of the flyover and target points to calculate the north-south and east-west range differences. Use these ranges to solve for the hypotenuse of a right triangle. This is the approximate range between the fixes. The internal angles can then be solved for and added or subtracted from 0°, 90°, 180°, 270° or 360° to obtain the approximate true bearing between the points. Finally, variation is added to the true bearing to obtain magnetic bearing.

$$\Delta nm=(\Delta_{Lat})\left(\frac{1\ nm}{min}\right)$$
$$\Delta nm=(\Delta_{Long})\left(\frac{1\ nm}{min}\right)[\cos(LAT)] \quad (21)$$
$$M_{bearing}=T_{bearing}+V$$

Δnm=the difference in nautical miles between the surveyed points along the north-south or east-west axis.
Δ_{Lat}=the difference between the latitude of the surveyed points in minutes.
Δ_{Long}=the difference between the longitude of the surveyed points in minutes.
Lat=the numerical average of the latitude of the two surveyed points in degrees.
$M_{bearing}$=actual magnetic bearing from the fly-over point to the radar target.
$T_{bearing}$=actual true bearing from the fly-over point to the radar target.
V=magnetic variation.

The difference between the actual and measured bearing and range are the bearing and range error. Relate the bearing and range error to the utility of the radar derived target position for

navigating to the target and for input to standoff weapons.

2.4.7.7. Data Cards

A sample data card is presented as card 30.

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CARD NUMBER ___ TIME ___ PRIORITY L/M/H

AIR-TO-GROUND RANGE AND BEARING ACCURACY

[OVERFLY THE VISUAL POINT AT ___ FEET AGL AND ___ KIAS. DESIGNATE THE RADAR TARGET BEFORE FLY-OVER.]

VISUAL FLYOVER POINT_____

RADAR TARGET_____

BEARING/RANGE_____/_____

HEADING_____

ALTITUDE_____

[QUALITATIVELY EVALUATE THE UTILITY OF THE BEARING/RANGE ACCURACY FOR INGRESS NAVIGATION AND TARGET DESIGNATION FOR STAND-OFF WEAPONS.]

EFFECTS:

Card 30: Air-to-Ground Range And Bearing Accuracy Data Card